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ABSTRACT

This publication, based on a 1991 Council of Graduate Schools (CGS) "Idea Exchange" meeting, addresses the issue of enhancing minority transition into graduate education, and provides an in-depth look at several types of institutional partnership programs involving universities, corporations, or research laboratories, designed to encourage minority students to go on to graduate school. Specific topics cover: (1) minority enrollment trends in graduate study, (2) improving pipeline transitions for minorities, and (3) laying the groundwork for institutional cooperation in identifying and promoting talented minority undergraduates. Also provided is a synthesis of various presentations delivered at a CGS meeting by representatives of eight institutional partnerships, alliances, and consortia, as well as the written reports and groups discussions that accompanied them. These institutional partnership programs are discussed within four categories: institutions and consortia, institutions and corporations, institutions and national laboratories, and institution-institution agreements. The publication concludes with a review of the principles of effective institutional cooperation. (GLR)

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THE
CGS IDEA
EXCHANGE

SUMMER
MEETING
1991

ENHANCING THE MINORITY PRESENCE IN GRADUATE EDUCATION III: INSTITUTIONAL PARTNERSHIP PROGRAMS

HE026 350

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Enhancing the Minority Presence in Graduate Education, 1989

Enhancing the Minority Presence in Graduate Education II: Assessing Progress, 1992

Enhancing the Minority Presence in Graduate Education III: Institutional Partnership Programs, 1992.

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ENHANCING THE MINORITY PRESENCE IN GRADUATE EDUCATION III: INSTITUTIONAL PARTNERSHIP PROGRAMS

COUNCIL OF GRADUATE SCHOOLS

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Table of Contents

Foreword v
Introduction 1
Pipeline Transitions 3
Two-Year/Four-Year Transfer 3
Laying the Groundwork for Institutional Cooperation 4
CGS Institutional Partnerships Project 5
Institutions and Consortia 5
CIC Alliance for Success 5
The Consortium for Minorities in Teaching Careers 9
Institutions and Corporations 10
The Science and Technology Alliance 10
Tuskegee University-Hughes Aircraft Company 12
Institutions and National Laboratories 13
Lawrence Berkeley Laboratory/Jackson State University/ Ana G. Méndez Educational Foundation Science Consortium 13
NASA Programs 16
Institution-Institution 19
Tougaloo College-Brown University 19
Consortium for Graduate Opportunities for American Indians 21
Encouraging Minority Participation in Graduate Education 22
Helping Minority Students Who "Stop Out" 22
Recruiting Through Student Organizations 23
Faculty Members as Effective Graduate Recruiters 23
Providing Money/Taking Calculated Risks 24
Principles of Effective Institutional Cooperation 25
A Range of Options 25
Promoting a Triangular Relationship Through Institutional Partnership Programs 25
Foundations of Institutional Partnerships 26
List of Participants 29

Foreword

In a series of meetings called "Idea Exchanges," CGS has been exploring various approaches to enhancing minority participation in graduate education. This volume represents the outcome of one such meeting, and provides an in-depth look at several types of institutional partnership programs involving universities, corporations, or research laboratories that are designed to encourage minority students to go on to graduate school.

Much of the general narrative in this document was adapted from an essay by Clara Sue Kidwell, Associate Professor in the Native American Studies Department at the University of California at Berkeley and former Dean in Residence at CGS, entitled "Minority Progress Through the Educational Pipeline." Kay Hancock, Information Officer at Vanderbilt University, served as editorial consultant and prepared the first draft of the document.

Special thanks are due to Mark Clark, CGS Dean in Residence for 1990–91, who organized the meeting, and to Leslie McLemore, Chair of the CGS Advisory Committee on Minority Issues in Graduate Education, who chaired the meeting.

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Jules B. LaPidus
President
Council of Graduate Schools
March 1992

Introduction

Given the projected rate of faculty retirements through the 1990s and the shrinking of the college age population cohort, many educators are concerned about the need to provide new faculty for America's colleges and universities. Since faculty positions will continue to require graduate education at least through the doctoral degree, the concern extends to the pool of potential students available to fill the pipeline to doctoral degrees. By the year 2000, the 20–25 year age group, from which graduate students traditionally have been drawn, will be approximately 20 percent smaller than it was in 1980. It also will be made up of a much larger percentage of people of African American, Hispanic, Asian, and Native American origin. A significant proportion of the Hispanic and Asian populations will be immigrants whose native language is not English. Thus the traditional pool of potential graduate students is growing simultaneously smaller and more diverse and will be composed increasingly of individuals from groups that have been underrepresented in graduate education. That creates two options for increasing the number of people entering doctoral studies: one is to expand the pool to include older students, perhaps those who have been out of school for some time; the other is to increase the percentage of those students in the traditional pool who go to graduate school. Since the percentage of baccalaureates who go on to doctoral study is quite small, even large decreases in the total pool need not lead to decreases in the number of those electing this path. The key is increasing the yield; making more options available to undergraduates and convincing more of them to go on.

Coupled with the changing demographics of American society is a growing concern for American competitiveness in international markets. American students are not entering Ph.D. programs in science and engineering in sufficient numbers to maintain the technological lead that has undergirded the country's strength in the world economy.[1] The percentage of Ph.D.s in the physical sciences and engineering granted to American citizens shows a significant decline between 1970 and 1990—from 83.3% to 60.5% in the physical sciences, and from 73.6% to 42.9% in engineering.[2] The pool from which graduate education in the sciences draws appears to be drying up.

In 1990 minorities earned 9.4% of all doctorates awarded to U.S. citizens. The underrepresentation of members of American minorities in graduate education is due to a large extent to their attrition at various stages of the educational process and to qualified minority students choosing options other than graduate school. What-

[1]Erich Bloch, *Basic Research: The Key to Economic Competitiveness*. Washington, D.C.: National Science Foundation, 1986; Government-University-Industry Roundtable, *Nurturing Science and Engineering Talent*. Washington, D.C.: National Academy Press, 1987; U.S. Congress, Office of Technology Assessment. *Educating Scientists and Engineers: Grade School to Grad School* OTA-SET-377. Washington, D.C.: Government Printing Office, June 1988.

[2]*Summary Report 1990: Doctorate Recipients from United States Universities*. Washington, D.C.: National Academy Press, 1990, 10.

ever the reasons, to ensure the health of U.S. education at all levels, indeed the health of our society, the pool of minority students participating in graduate education must be expanded.

Demographic trends are subject to change through intervention. To encourage greater minority participation in graduate education, universities can do more than simply wait at the end of the pipeline for the trickle of minority students to come through. "Early identification" is a viable approach to recruitment; the premise is that students can be encouraged to pursue graduate study if their talent is identified at an early stage in their college careers and nurtured throughout the undergraduate years.

By ensuring that students who have the potential for graduate work have every opportunity possible to develop that potential and by planning for a smooth transition from undergraduate to graduate study, the "early identification" approach facilitates greater and more successful participation of students in graduate education. Early identification and careful preparation not only enhance recruitment of minority students but help forestall situations in which a minority student in need of remediation is admitted to a graduate program and then stigmatized as either an "affirmative action" or "unqualified" admit.

Institutional partnership programs provide one means by which talented minority students can be identified at an early point in their undergraduate careers and prepared to attend graduate school. Graduate deans may find the institutional partnership model especially appropriate for their participation. As senior administrators in their institutions, they can initiate with other institutions cooperative efforts that are designed to attract minority students into the graduate school pipeline.

Pipeline Transitions

Two-Year/Four-Year Transfer

Two major transitions occur in the pipeline at the college level. One is the transition from a two-year college to a four-year institution; the other is the transition from undergraduate to graduate education. Although none of the consortial or partnership arrangements discussed in this document focus on the first transition, it is a critical juncture for minority students and will be discussed briefly here.

Graduate deans can acquaint themselves with the relationship between two-year colleges and four-year institutions and find out what their own institutions are doing to promote articulation and transfer. Minorities are concentrated in two-year colleges, and their rate of transfer from those institutions to four-year programs is thought to be quite low.[3] A short monograph published by the American Association of Community and Junior Colleges describes three types of statewide articulation and/or transfer agreements: formal and legally-based policies (Florida and Illinois); state system policies (North Carolina, Washington, and Maryland) and voluntary agreements between individual institutions or systems (California and Michigan).[4]

Deans can look for two-year colleges that are making an effort to improve the transfer rate for students, especially for minority students, and invite faculty from those institutions to engage in discussions with faculty on their campuses. The Ford Foundation has developed an Urban Community College Transfer Opportunities Program aimed at strengthening the community college transfer function. In one part of the project, five community colleges in urban areas with significant minority populations have been funded to develop articulation agreements, to identify factors involved in student decisions to transfer or not, and to provide better services to students who wish to transfer.[5]

Another study funded by The Ford Foundation is of the articulation and transfer process between four American community colleges and four state universities. The study utilizes an ethnographic approach to discover the factors that impede or promote the transfer of American students from community colleges to four-year institutions and the factors involved in the success or failure of students who do transfer.

More recently, in 1989, The Ford Foundation provided funds for the establishment of The National Center for Academic Achievement and Transfer, under the auspices of the American Council on Education. The purpose of the center is to strengthen the

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[3]Reginald Wilson and Deborah J. Carter, *Minorities in Higher Education: Seventh Annual Status Report 1988* (Washington: American Council on Education, 1988), 1; James R. Mingle, *Focus on Minorities: Trends in Higher Education Participation and Success* (Denver: Education Commission of the States and the State Higher Education Executive Officers, July 1987), 20–21; Shirley Vining Brown, *Minorities in the Graduate Education Pipeline*. Princeton: Educational Testing Service, 1987, 4–6.

[4]Frederick C. Kintzer and James L. Wattenbarger, *The Articulation/Transfer Phenomenon: Patterns and Direction* (Washington, D.C.: American Association of Community and Junior Colleges, 1985), 22.

[5]Ford Foundation, *New Initiatives for Transfer Students* (New York: Ford Foundation, 1984).

transfer relationship between community colleges and four-year institutions, especially for low-income black and Hispanic students. Its primary goal is to increase the numbers of students who transfer and achieve baccalaureate degrees.[6]

Cooperative agreements between institutions can give students a realistic sense of how they can use their community college courses in a four-year program. Graduate deans can inform community college students of graduate school requirements so that they can see how their undergraduate preparation relates to preparation for graduate school. Conversations between graduate deans and community college faculty and administrators also can explore the factors affecting minority student attendance in junior college and how they view these colleges in terms of preparation for further higher education or as means to gain specific job skills. Community college faculty can encourage students to consider graduate school, particularly if these faculty members are considered as a resource for the early identification of talented students.

Laying the Groundwork for Institutional Cooperation

How can institutions that differ widely in scope and resources work together to promote the early identification of talented minority undergraduates and to assure that they are recruited by and accepted into appropriate graduate programs? Institutions entering into cooperative agreements for the purpose of encouraging minority participation in graduate education must establish a formal structure that will promote full understanding of the strengths and weaknesses of the student's undergraduate preparation vis à vis the demands of the research institution. Defining the expectations of the cooperating institutions about what each can contribute to the partnership is a major issue.

Organizational issues also arise in establishing cooperative agreements between and among institutions. Central administrative responsibility, staff time, incentives for the institutions to participate, and a financial commitment by one or more of the participants, or an external agency, are essential ingredients in all interinstitutional arrangements. All of these issues are illustrated and discussed in this document. The emphasis, in all cases, is on exploring how things really work, the pitfalls to avoid, and the factors that seem to be associated with success.

Institutional partnership programs can help to increase the flow of minority students through the educational pipeline. Provosts, college deans and graduate deans can play an important role in the development of that pipeline. In their role as institutional leaders, they can influence the commitment of resources to the development of cooperative programs; they can take a leadership role in encouraging faculty members to identify talented students; finally, their offices can serve as the formal links between institutions.

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[6]*Setting The National Agenda: Academic Achievement and Transfer* (Washington, D.C.: American Council on Education, 1991).

CGS Institutional Partnerships Project

The Council of Graduate Schools' (CGS) Institutional Partnerships Project had its origins in discussions of the CGS Minority Advisory Committee on Graduate Education. In June 1991 the CGS brought together in Washington, D.C., representatives from eight partnerships, alliances, and consortia that have been created to increase the number of students from underrepresented minority groups who will attend graduate school and enter careers in teaching and research. Representatives from each program discussed the background, nature, and workings of their program, as well as its strengths and weaknesses. In all cases, an attempt was made to reflect on what lessons had been learned in the course of initiating and developing the program. It is important to recognize that the partnerships described were initiated at different times and thus represent different stages of development. A synthesis of those presentations, and the written reports and group discussions that accompanied them appear here to serve as an information source and a guide to institutions contemplating cooperative ventures designed to bring more minority students into graduate education. Four categories encompassed the institutional partnership programs discussed at the June meeting: (1) institutions and consortia, (2) institutions and corporations, (3) institutions and national laboratories, and (4) institution-institution agreements.

Institutions and Consortia

CIC Alliance for Success

The Alliance for success is a consortium of 14 major research institutions that make up the Committee on Institutional Cooperation (CIC)[7] and six Historically Black Colleges and Universities (HBCUs).[8] Established in 1986, the Alliance is a comprehensive, cooperative effort to increase the numbers of minority faculty members nationally. The Alliance programs and initiatives are designed to affect the pipeline at several critical stages from pre-college through graduate research.

The Summer Research Opportunity Program (SROP), which has been in effect since 1986, is the cornerstone of the Alliance. It provides minority sophomore and junior undergraduates, in all disciplines, with a research experience for an eight- to ten-week period during the summer. During the program, students engage in research with a faculty mentor and/or research team; acquire information about graduate school and financial aid; develop verbal and written communication skills; and gain self-confidence. Since 1986, more than 2,000 students have participated in the SROP, and more than two-thirds of the graduates are now in graduate or professional school.

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[7]The University of Chicago, University of Illinois at Chicago, University of Illinois at Urbana-Champaign, The University of Iowa, University of Michigan, University of Minnesota, University of Wisconsin-Madison, University of Wisconsin-Milwaukee, Indiana University, Michigan State University, Northwestern University, The Ohio State University, The Pennsylvania State University, Purdue University.

[8]Coppin State College, Jackson State University, Lincoln University, Prairie View A&M University, Texas Southern University, Xavier University of Louisiana.

Future Alliance plans include implementation of the following initiatives:

- Coordination of Pre-College Programs to enhance recruiting efforts directed at increasing minority student participation in higher education. The thrust of this initiative is information-gathering: bringing together people who run the programs, developing an inventory of all the pre-college programs on Alliance campuses, compiling a database of students who are participants in those programs so that they can be recruited to any of the 20 Alliance campuses.
- Curricular Enhancement and Enrichment to develop and implement pedagogical changes that will augment retention and advancement of targeted student groups.
- Summer Freshman Institutes for undergraduates to provide nurturing and academic stimulation, enhancement of problem-solving and critical thinking skills, as well as preparation for the SROP research experience. These institutes will occur at the end of the first year.
- Academic Year Programs to extend the SROP experience by offering independent study or teaching opportunities so that students can continue their summer research during the academic year. About half of the SROP participants say that they continue their research after they return to their home campuses; Academic Year Programs seeks to expand that number by providing a variety of ongoing research experiences.
- Graduate Student Support Programs to provide minority students with the financial and academic support essential to their successful completion of graduate study and the pursuit of faculty careers. CIC already has fellowship programs for minorities in the social sciences and humanities, and has recently received support for students in sciences and engineering, which will be directed toward students who have participated in the SROP and then are accepted by one of the CIC graduate schools.
- Faculty Development and Interchange Programs to facilitate interaction and cooperation among faculty on individual campuses as well as across institutions. These Alliance programs will entail research enhancement seminars and workshops, short- and long-term faculty exchanges, joint and visiting faculty appointments, collaborative research activities, and other opportunities to expand faculty participation in Alliance programs.

The Alliance is asking member colleges and universities to cooperate in a very competitive environment and to compete in a cooperative environment. Chief academic officers at the participating institutions provide the overall governance for the Alliance, but their key role is to work within their institutions to ensure that the mechanisms are in place to involve faculty and staff and students on their campuses in Alliance programs.

Chief academic officers appoint members of the Alliance's steering committee which is responsible for setting the Alliance's policy and priorities, reviewing and evaluating all of the group's programs, fostering new initiatives, and providing mechanisms

for sharing information—a critical need in a group of this size. Each steering committee member chairs an Alliance Advisory Committee on his or her campus, and that committee consists of faculty and staff members who are participants in the Alliance programs described above.

The Undergraduate Institution. To ensure the success of minority undergraduates in the Alliance's Summer Research Opportunities Program, the undergraduate institutions must carefully select SROP participants and provide them with adequate research experiences prior to the SROP. At one of the undergraduate institutions (Coppin State College), most of the SROP participants were either Ronald E. McNair Postbaccalaureate Achievement Students or in the Honors Program. Department chairs nominate other students for SROP. The college requires students to participate in academic year roundtables that anticipate the SROP experience, and the McNair Program requires its students to participate in research projects during the academic year. Additionally, the McNair Program conducts an orientation for participants that is led by former SROP participants. To motivate other students to aspire to summer placements, the McNair Program hosts a reception honoring summer research participants.

For students at Coppin State College, the SROP enables them to win places in graduate programs at major research universities. Two Coppin students have begun graduate studies at the same institutions—the University of Illinois at Urbana-Champaign and the University of Wisconsin-Madison—where they engaged in summer research. Without the summer experiences, both students have said that they would not have considered those universities and probably would not have gone on to graduate school.

Weak links in the program from the perspective of the undergraduates' home institutions are the following:

(1) Relatively late identification of summer mentors and research projects prevents students from exploring the subject in advance and developing ties with their mentors before going to the summer research sites; it also makes it difficult for the summer mentor and the academic year mentor to establish a relationship that would enhance the student's research experience.

(2) The students' undergraduate institutions receive a paucity of information about the identities of the students' summer mentors or aspects of their summer experience while the students are engaged in their summer research experiences. To keep informed, Coppin State College has designed a form for their students to complete and return after they arrive at their summer sites.

(3) Lack of timely feedback from summer mentors inhibits the support that students' undergraduate institutions can provide. Coppin State College has developed a feedback form for mentors, which they ask their students to ensure that the mentors complete and return. When the director of the Alliance for Success program at the undergraduate institution receives a response from the student's summer mentor at least by late August, the director can address the mentor's concerns with the student early in the fall semester.

(4) No mechanism now exists for students to continue their summer research projects once they return to their home institutions. A major task ahead for the SROP is to create a real bridge between the students' summer and academic year experiences, thereby strengthening the SROP as the cornerstone of the Alliance.

The Major Research University. Applications for the SROP are collected in the CIC office and sent to CIC institutions for review. A major research institution, like the University of Illinois, Urbana-Champaign, will select students whom they can place with appropriate mentors and support financially. Because funding comes from a number of sources, a research university is not always able to select every student interested in participating in its program. The SROP at the University of Illinois began with ten students in 1986 and had grown to 89 by the summer of 1991.

To ensure institutional commitment to the SROP, the Graduate School at the University of Illinois at Urbana-Champaign has an advisory committee composed of an associate or an assistant dean of each of the undergraduate colleges. Applications from Alliance students are sent to the major colleges, which then identify a department head or faculty member who will suggest appropriate placements. This decentralized placement process allows each of the colleges to claim ownership of the program and remain committed to it. Another mechanism for reinforcing a sense of ownership of the program is that each college makes a financial contribution to the support of SROP students.

Once summer placements are found for students, the Alliance office at the host university gets in touch with the student directly about the research he or she will be doing. Because of the complexities of the process, placements can be late. When students arrive on campus, however, they begin to relate to a mentor, and the faculty members involved become interested in these students and their welfare.

Problems perceived by a host research university include how to maintain quality when there is pressure to increase the number of participants; how to maintain institutional commitment in tight budgetary times; and how to continue to involve the colleges, e.g., in the teaching of mini-courses, without overworking the students.

Funding. The major research universities participating in the Alliance for Success provide the bulk of financial support for it. Some support from the federal government comes from Title IX grants, the McNair Achievement Program, and the U.S. Department of Agriculture. The Mellon and Lilly Foundations have given grants to the Alliance, and it has used that money as leverage to have the institutions contribute additional funds.

Lessons Learned. Several issues are of concern to the Alliance:

(1) Long-term effect. It is essential to transform the culture of campuses so that programs like these are viewed as part of the way universities work, rather than as extraordinary or one-time activities. The Alliance has brought together faculty members in mathematics and chemistry to talk about what they can do within their disciplines to start transforming the curriculum so that they can better attract and retain students in those fields and in the sciences and engineering. Similar efforts will be made across the disciplines.

(2) Sustaining the institutional commitment of faculty and staff members who contribute their time and energy. Institutions participating in the Alliance for Success need to find ways to recognize and reward faculty members so that they will continue to participate. To encourage continued faculty participation, the programs must become an integral part of the faculty members' activities and not be viewed as an add-on.

(3) Bringing new personnel up to speed. Chief academic officers and members of the steering committee change every year. A mechanism is needed to bring all of the participants together so that seasoned people from other institutions can help inform and enlighten the new members of the committee. The Alliance also conducts continuous ongoing evaluations of its programs so that they can report on the successes and deal with the weaknesses.

(4) Sustaining financial support. Grant-writing consumes a major portion of the director's time. The agendas of the funding agencies and the Alliance for Success may differ slightly, so the challenge is to balance the funding agency's interests with the Alliance's goals and meld them. The member institutions now are paying 60 percent of the cost for the SROP, thereby making them a funding agency. The Alliance must be responsive to the institutions' interests and concerns yet be sufficiently focused to ensure that everyone is headed in the same direction.

(5) With 20 institutions and a wide variety of faculty, staff, and students, many opportunities exist to make things happen. The large size of the Alliance can, however, create an administrative nightmare; the complexity of pulling all the components together requires a great deal of attention.

(6) Communication and coordination issues. It is easier to generate cooperation across the campuses than within an individual campus. Working with faculty members within the disciplinary areas will help engender that intra-institutional awareness and cooperation.

The Consortium for Minorities in Teaching Careers

Increasing the number of minority teachers for a growing minority school population is a national concern underlying the creation in 1989 of a Consortium for Minorities in Teaching Careers. This Consortium brings together, for the first time, two- and four-year colleges, research institutions, historically black colleges and universities (HBCUs), and predominantly Hispanic institutions (PHIs). The ten cooperating institutions[9] have signed a formal Memorandum of Understanding and Intent to develop, over the next ten years, a comprehensive national model to increase the number and enhance the preparation of minority teachers.

Together these varied institutions can address needs and develop programs that complement each other at all levels of the pipeline, from college-based pre-college

[9]California State University, Dominguez Hills; The City College of New York; Fordham University; Eugenio Maria de Ilostos Community College, New York; University of Iowa; Knoxville College, Tennessee; Metropolitan University, Puerto Rico; Morgan State University, Maryland; Turabo University, Puerto Rico; Xavier University, Louisiana.

early identification and enrichment programs, through two-year transfer programs, bachelor's degree programs, and graduate program alternatives up to the Ph.D. degree, thereby providing a continuum of programs for minority students. The proposed program is national in scope and will develop replicable models to address the needs of diverse minority populations, including bilingual models, in a variety of geographic settings across the country.

Fordham University, a member of the Consortium, already has had experience in educating doctoral students from Puerto Rico. Through a program that began in 1981 with the Ana G. Méndez Educational Foundation, 32 Puerto Rican students earned their Ph.D. degrees at Fordham. The University also has a Fellows in Teaching Program in which 40 percent of the students are minorities. Students with bachelor's degrees from liberal arts programs and excellent undergraduate GPAs can earn master's degrees in this program and become licensed teachers. Those who are admitted to the 15-month program receive full tuition plus a small stipend and medical insurance.

Finding long-range funding for the Consortium is now a priority. The Carnegie Corporation has given the Consortium a $25,000 planning grant, but funds are being sought to develop over the next decade a comprehensive national program to increase the number of minority teachers.

Institutions and Corporations

The Science and Technology Alliance

Created in 1987 by the Department of Energy (DOE), the Science and Technology Alliance includes three DOE national laboratories, three universities whose student populations are predominantly minorities, and three private corporations. Alliance members are the Fundacion Educativa Ana G. Méndez (Turabo University) in Puerto Rico, a Hispanic university; New Mexico Highlands University, a predominantly Hispanic institution; North Carolina A&T State University, an historically black university; Los Alamos National Laboratory; Sandia National Laboratories; Oak Ridge National Laboratory; and three private corporations—AT&T, Hewlett-Packard, and Martin-Marietta.

Because the Department of Energy is made up in large part of major national research centers scattered around the country, it can provide colleges, universities, and pre-college school systems with large minority populations the opportunity for their faculty members and students to interact with DOE scientists in the national laboratories. The Alliance is committed to fostering long-term relationships between the national laboratories and the participating universities.

One approach utilized by DOE is to help develop university science, engineering, and technology programs by using national laboratory staff and resources. This may involve helping universities to develop new courses and research programs, or to acquire or borrow equipment from DOE laboratories, by providing access to the laboratories' computers, or by lending scientists to the universities. A second

approach provides research opportunities and programs for faculty, students, and staff from Alliance universities at the national laboratories. The Alliance also has committed itself to aggressive pre-college programs at Alliance universities to prepare high school students for college-level study.

Each of the partnership institutions came into the Alliance with a certain set of needs. Oak Ridge National Laboratory has been able to share its strength in advanced materials research to help North Carolina A&T develop a new research capability in that area. Approximately a million dollars of computer equipment donated by AT&T leveraged another $1.8 million from Digital Corporation to provide additional computer and equipment support. Money from DOE or one of the industries involved often can be used as leverage to get additional financial support from another source for a minority institution.

The Alliance has helped New Mexico Highlands University (NMHU) win accreditation for its Engineering and Computer Technology program. Los Alamos National Laboratory provided technical assistance to the Department of Engineering Technology by developing teaching laboratories and laboratory curricula, as well as a variety of other support services. Sandia National Laboratories (SNL) assigned staff to work with NMHU faculty to develop a strategic plan for the department, teach courses, and assist in the development of course curricula, the design and development of teaching laboratories, and the development of a technical library. Through the Alliance, Hewlett-Packard donated more than $150,000 worth of computer equipment for use in the engineering technology laboratories.

At Turabo University, one of the member institutions of the Fundacion Educativa Ana G. Méndez, the Alliance played a key role in the establishment of a School of Engineering. The first dean was on loan from the technical staff of Sandia National Laboratories. He helped develop the first curriculum and laid the groundwork for the creation of the School of Engineering. The current dean is also a member of the SNL technical staff and is overseeing the implementation of the first-year curriculum. AT&T contributed $175,000 worth of computer equipment for the School's engineering laboratories and lent a professional staff person to serve as a faculty member.

North Carolina A&T University advised Turabo University about curriculum development and textbook acquisitions, so the Alliance relationship is between universities as well as among universities and DOE national laboratories. The School of Engineering also implemented a strong pre-college program to attract and retain engineering students. The Alliance worked with the school to develop an important network of resource institutions that will contribute to the school, as well as to establish a long-term plan for the school and put a five-year budget in place.

Industrial participation in the Science and Technology Alliance is not just monetary. The corporations contribute scientists from their staffs to work with the deans and faculty of the three universities. They organize programs such as career days and offer guidance on opportunities in industry in order to enhance the environment of support for students.

Funding. Funding for the Science and Technology Alliance has come from DOE and the participating industries and universities.

Lessons Learned. (1) A great deal of long-term planning is necessary to nurture a productive relationship among a federal laboratory, a private laboratory, and a minority institution so that the participants provide the kind of assistance that helps rather than hinders. Paying a lot of attention in the planning stage to what the universities really needed and what the DOE laboratories could provide was essential to establishing a productive relationship.

(2) DOE and the other participants are in the Science and Technology Alliance for the long haul. To strengthen programs in science, engineering, and mathematics at these institutions and to attract additional numbers of minority students into careers in those fields, the relationship has to be built on a foundation of mutual trust and to extend over many years.

(3) Involvement at the pre-college level is important. Recruiting young people into science and engineering and retaining them in those fields must begin before the college years.

Tuskegee University-Hughes Aircraft Company

Tuskegee University is a small, private but state-related university in central Alabama. It is an historically black institution with an enrollment of 3,500, more than 1,000 of whom are in engineering and architecture. Hughes Aircraft Company, an aerospace company based in southern California, designs, develops, and manufactures state-of-the-art electronics.

Recognizing the key role played by HBCUs in the development of the minority engineering pool in the U.S., as well as their need for industrial support, research groups at Hughes have entered into several collaborative programs with HBCUs: Space and Communications Group/Morgan State; Ground Systems Group/Jackson State; and the Missile Systems Group(MSG)/Tuskegee University. Each agreement focuses on the objective of research collaboration and other contractual involvement between the parties.

Four elements make up the Missile Systems Group/Tuskegee agreement which began in 1990:

(1) Establishment of a microwave capability is the cornerstone of the agreement because both Hughes and Tuskegee recognize the need for development of radio frequency and microwave expertise at the undergraduate level. Hughes' support includes funds to purchase equipment; first-year funds of $50,000 were leveraged with Hewlett-Packard, a chief supplier of microwave equipment, to purchase some $100,000 in equipment. Hughes and Tuskegee also are collaborating in the technical support for the laboratory curriculum. Electronics engineers at Tuskegee have gone to Hughes for periods of time; the department head spent a summer with Hughes retooling in his area, RF electronics.

(2) In the Technical Assignment Program, selected microwave engineering faculty and advanced students participate in summer, sabbatical, or cooperative education assignments at the Missile Systems Group.

(3) Participation in a long-standing Hughes program, the Minority Student Support Program (MSSP), provides for placement of two freshman students each year at an MSG facility, funding to support tutoring, funding to enhance MITE (Minority Introduction to Engineering), and/or FASTREC (Freshman Accelerated Start-up Training for Retention in the Engineering Curriculum) programs. During two one-week sessions each summer, the MITE program invites 10th- and 11th-grade students to live on campus and participate in engineering orientation activities.

Elements of the Missile Systems Group/Tuskegee agreement are part of a three-year pilot program, which is intended to grow into a long-term relationship. Tuskegee hopes to establish through the collaborative arrangement a laboratory for microminiaturizing microwave circuitry. Technical collaboration between Hughes and Tuskegee is the ultimate goal. Hughes will seek to identify specific tasks on which Tuskegee can provide technical assistance in a subcontractor capacity. The last objective is for Hughes and Tuskegee to pursue joint contracts.

Lessons Learned. In programs of this type, involving cooperative development of technology, it is extremely important that issues relating to publication and patents be resolved at the very beginning.

Institutions and National Laboratories

Lawrence Berkeley Laboratory/Jackson State University/Ana G. Méndez Educational Foundation Science Consortium

When the Lawrence Berkeley Laboratory (LBL), Jackson State University (JSU) and the Ana G. Méndez Educational Foundation (AGMEF) signed a formal Memorandum of Understanding (MOU) in 1983 to establish a Science Consortium, it was the first such collaboration among an Hispanic university system, an historically black university, and a national laboratory. LBL and JSU had signed a previous MOU in 1981. Supported by the U.S. Department of Energy's University and Science Education Programs in the Office of Energy Research, the Consortium is designed to advance the science and technology programs of JSU and the University System of AGMEF.

Long-range goals of the Consortium were to expand and strengthen undergraduate and graduate academic/research training programs, increase the number of minorities entering Ph.D. science programs, expand collaborative research projects, and develop centers of scientific excellence. To accomplish these objectives, the Consortium adopted a comprehensive approach ranging from pre-college programs to faculty development.

In the pre-college area the focus is on teacher education and honor student programs. Undergraduate student development takes place through a future scientist track, honors programs collaborations, and a research semester at LBL. To foster graduate

student development, graduate assistantships and research assistance are provided. The research component of the Consortium involves collaborative LBL/JSU/AGMEF research projects, faculty-student teams research, and campus-based research. Distinguished lecture series, short courses, and an energy research conference benefit both graduate and undergraduate students. In the critical area of faculty development, the Consortium provides assistance for new Ph.D. faculty members, giving them the opportunity to initiate research activities and to work with faculty members with similar interests at other Consortium institutions. All faculty members in the sciences have an opportunity for a summer faculty appointment at LBL in order to engage in research activities in the national laboratory, and to continue that research upon returning to their respective institutions.

Benefits of the Science Consortium from the University Perspective. One benefit is the opportunity for both faculty and students to participate in collaborative projects which spin off into other kinds of research activities and initiatives. Second, the Consortium permits minorities to be exposed to an environment that demystifies research, helping them to understand that they do have the capability to engage in research. A third benefit is the cross-cultural interaction that underscores for Consortium members the richness and beauty of cultural diversity.

From the Perspective of Lawrence Berkeley Laboratory. The Science Consortium has been a model program for giving LBL access to minority students who ordinarily have not considered science and engineering careers. LBL has learned the important role of a well-articulated research agenda in institutional development. Through the Science Consortium's research agenda, JSU and AGMEF continue to grow and to develop stronger programs in their science and engineering curricula. The number of students participating in the summer and academic year research programs is relatively small compared with the number of students that benefit from stronger programs in science and engineering at their home universities. The continuing development of these programs is an advantage to all the students in those disciplines, and one that should lead to greater participation in graduate education research programs.

Milestones in the LBL/JSU/AGMEF Science Consortium are many. Among the ones with the most far-reaching ramifications was the initiation in 1989 of Summer Research Campaigns. The three Summer Research Campaigns—El Yunque Environmental Research Campaign (Puerto Rico), Toxic Metals and Organics in the Environment (Mississippi), and Microbial Environmental Restoration using Innovative Technology (MERIT) (California)—each receive funding of $75,000. Support at that level is high enough for scientists to put these projects on their career path and to have a real stake in the project's success. They devote more time and attention to the project; many meetings take place to develop the research agenda, and, in the process, the undergraduate curriculum is strengthened.

A second milestone in 1989 was the initiation of the Undergraduate to Graduate School Bridge program. Many students who earn their B.S. degrees from Jackson State University or the Ana G. Méndez Educational Foundation are very talented but

may need some time to hone their research skills before going to graduate school. The bridge program offers them an interim year of research at LBL during which they can prepare for the GREs and gain additional research experience. Through this program students are accepted into some of the top graduate schools in the country.

In 1990 a milestone was the establishment of the Five Year Plan and Implementation Plan. While the plans themselves are useful, the process through which the plans are developed is more valuable and stimulates action. Administrators in the Science Consortium's institutions do the planning and are able to identify areas where more articulation between institutions is needed.

Principal components of the Science Consortium have changed over the years. In 1983 they were M.S. and Ph.D. programs, faculty internships, joint faculty/staff appointments, student co-op programs, graduate studies, courses/mini courses/lectures and seminars, development of undergraduate research, development of academic facilities, and computer science academic program development. By 1991 the principal components had become more general: student development through research participation, pre-college outreach programs, faculty development through research and professional activities, support for collaborative and summer research, seminar/lecture/conference series, curriculum development, evaluation, and dissemination.

Keys to Successful Collaboration for Education and Research.

(1) Funding from the Department of Energy is stable and equally distributed so that each of the partners directs a major segment of the activities underway.

(2) Flexibility in the program allows the Consortium to seize opportunities to support people and projects.

(3) The institutional umbrella is important for recognition, sharing connections, and credibility. The Science Consortium gives DOE and LBL access to minority students and faculty members at JSU and AGMEF and through that affiliation DOE and LBL gain credibility.

(4) The "action committee" of coordinators meets quarterly to implement programs and resolve misunderstandings. This committee keeps the momentum and impetus alive.

(5) LBL serves as the lead institution because it has many resources and support services to lend to the overall effort.

(6) Collaborative research related to the long-term career interests of the scientists is considered important and contributes to individual and institutional development.

(7) Institutional patience involves a long-term commitment for the Consortium partners to work together and to work out differences. Everyone is getting something out of the partnership, which keeps the Consortium going.

Lessons Learned. Several factors are critical to the success of the Science Consortium. Of them the most important are (1) financial support from DOE; (2) administrative support from all three institutions; (3) inter- and intra-institutional planning (plan-

ning is a dynamic process; as environments change, the Consortium has to be able to respond to the changes); (4) evaluation; it is important to be able to document what the program has accomplished.

A remaining challenge is to broaden the base of minority students going into science and engineering careers by identifying and encouraging students who otherwise would not choose that career path.

NASA Programs

NASA's *Graduate Student Researchers Program* began in 1980. Although the program was successful, NASA was concerned that relatively few members of underrepresented minority groups were participating. Thus, in 1987, NASA introduced the *Underrepresented Minority Focus Component*. This program enlists the assistance of university principal investigators on NASA research grants in locating promising minority graduate students who then compete for NASA support. Students selected for the program collaborate with university investigators and NASA technical officers. Stipends are $16,000 for up to three years, supplemented by a $3,000 university allowance and a $3,000 student allowance for tuition and books.

As in the *Graduate Student Researchers Program*, minority students selected by NASA field centers must spend a period of time—from several days to several weeks—at the center, taking advantage of its research facilities and working with center personnel. Students selected by NASA Headquarters will be offered an opportunity to work at a field center engaged in related work.

Students attending HBCUs are encouraged to apply to the Graduate Student Researchers Program, but are ineligible for the Underrepresented Minority Focus Component, since they have access to NASA fellowships through other programs between NASA and HBCUs.

Observations. In the summer of 1991, 94 students were in the Underrepresented Minority Focus Component; 57 were pursuing the Ph.D. degree, and 37, master's degrees. More students in the minority program (40 percent) are seeking master's degrees, whereas 90 percent of the students in the Graduate Student Researchers Program are pursuing the Ph.D. degree. NASA is looking into the reasons for that difference.

The minority program also is not as competitive as the regular program. The Graduate Student Researchers Program receives about eight applications for every student selected; in 1991 the Underrepresented Minority Focus Component was undersubscribed, and NASA was trying to do some targeted recruiting for it.

NASA's Space Grant College and Fellowship Program. Established by Congress (Public Law 100–147) and funded since 1989, this program has among its objectives the recruiting and training of professionals, especially women, underrepresented minorities, and persons with disabilities, for careers in aerospace science and technology. Under the fellowship portion of the Space Grant program, designees awarded nearly 300 undergraduate and graduate fellowships and scholarships in 1990. Approximately 15 percent of the awards went to minorities, and 30 percent to women.

NASA Langley Aerospace Research Summer Scholars Program (LARSS). To motivate science and engineering students to earn Ph.D. degrees, seek careers in research, and develop an awareness of employment opportunities with NASA, NASA formed LARSS in 1986. Twenty-five students were in the inaugural group that summer, and 90–100 students participated in the ten-week research program in the summer of 1991. Each participant receives a $4,000 stipend, and the cost of the program is funded from NASA's budget for research and development.

Summer scholars are expected to conduct research with a mentor and produce a paper on the research activity. To be eligible to participate in the program, a student must be a rising junior, senior, or first-year graduate student (freshman students who participated the first year were demotivated by the rigors of research); have a 3.00 GPA on a 4.00 scale; be an engineering or science major; and have a strong interest in research, a letter of recommendation, and a resume. In the last two years, LARSS has modified the GPA requirement so that about five percent of their students are undergraduate science and engineering students with 2.3–2.4 GPAs. The program is beginning to experiment with mid-range students to find out if they can be prepared and motivated to seek the Ph.D. degree.

LARSS's intake survey at the beginning of a summer program included questions about graduate education. Only 25 percent of the students were interested in going to graduate school. After a summer of working under a mentor and listening to special career lectures, and participating in related program activities, 75 percent of those exiting the program indicated an interest in attending graduate school. Thus, LARSS appears to be successful in its efforts to motivate more students to pursue the Ph.D. in science and engineering.

NASA-University of Virginia Programs. In the University of Virginia experience, the impetus for increasing minority graduate enrollment and retention must come from partnerships with industry and government. NASA research grants at the University of Virginia not only provide financial assistance but require that minorities be involved in the research. That requirement makes faculty acutely aware of the importance of minorities in research and motivates them to find or "grow" talented, capable young researchers. This approach has helped the University of Virginia increase its graduate enrollment of minorities in engineering from four to 54 within a four-year period of time. The success of the graduate program has helped undergraduate recruitment and retention by providing role models, excellent teaching assistants and tutors, and researchers. UVA won a national award for an 88 percent retention rate of all students, including minorities.

To increase minority enrollment and retention at the undergraduate and graduate levels at the University of Virginia, the associate provost for academic support developed comprehensive support programs. Through a variety of programs, they seek to identify students, to prepare them, and to motivate them in high school. Introduction to UVA is a university-wide program for rising high school seniors, minority and non-minority. It brings them to campus for a week in July to attend

lectures, participate in laboratory demonstrations and tours, and gain first-hand computing and writing experience. A similar program is called the Minority Introduction to Engineering.

A Minority Research Assistantship Program for rising high school juniors gives them an opportunity to spend three months in the summer working with engineering faculty in their labs on campus. The program has been very successful because it does not coddle the students; they are screened very carefully and once they are in the program, they become full participants in a faculty member's research team. They actually learn computer programs, observe and help graduate students, and do computations. Many of the participants enroll in engineering programs at UVA or other institutions.

The University of Virginia has arrangements with the Southeast Consortium for Minorities in Engineering (SECME) and the Cooperating Hampton Roads Organization for Minorities in Engineering (CHROMES)—consortia with elementary, high school systems, colleges, and corporations seeking to increase the enrollment and retention of minorities in engineering. UVA works with these consortia to ensure that potential students are identified properly and prepared well. A result of these efforts is that 350 blacks enter UVA every year, and their retention rate is high.

Once the students are on campus, the university assists them with tutorials; a strong, proactive faculty advising program; an early warning system to identify students who are not going to class or doing homework regularly; and scholarships. Minority students often have to drop out of school because of personal or familial financial emergencies. A small loan fund in the office of the associate provost for student academic support is available to help students in such emergency situations. Every loan made under those circumstances in the past three years has been repaid. One of the challenges is to get funds from various sources so that support is available for students who need help.

Internships give students an early exposure to the professions. In Project View corporations bring students in for a week or two during the Christmas break and show them what the profession entails.

In the graduate component, about one-fourth of UVA's minority graduate students have been supported by NASA grants. Some already have received their Ph.D.s and are working in industry or academia. Many others are in the pipeline working on their Ph.D. or master's degrees.

Money is the critical missing ingredient. NASA, GEM, and the National Consortium for Educational Access, among other agencies, provide invaluable support to the University of Virginia. To expand the group of minority graduate students significantly, however, greater financial support is needed. Funds must be available for minority students whose undergraduate academic records may be uneven, but who have the potential to succeed in graduate school if they are given the opportunity and the support.

Institution-Institution

Tougaloo College-Brown University

In 1963 the presidents of Tougaloo College and Brown University, who were friends, decided to form a partnership between the two institutions. Thus began the longest-lived institutional relationship between an HBCU and a major research university.

At the outset, the relationship was very paternalistic. Brown University in Providence, Rhode Island, was the giver—fund raiser, source of faculty expertise—to Tougaloo College in Jackson, Mississippi. The faculty exchange program was one-way: Brown faculty became visiting professors at Tougaloo College, helping the faculty there transform a teacher's college curriculum into that of a liberal arts college. Tougaloo faculty members did not go to Brown.

The undergraduate exchange program was a real exchange from the beginning. Between 1967 and 1991 some 150 undergraduates have moved back and forth between Tougaloo and Brown. At first the exchange was general; students went for the enrichment of the semester and were not locked into a curricular scheme. Now some sentiment exists to use it to encourage Tougaloo students who show promise in a certain discipline to come to Brown and take courses in that field, with a view toward entering graduate school at a later date.

Five students have participated in the joint degree in engineering program and between five and six students in other graduate programs. The longest running component of the relationship is the Early Identification Program in Medicine (EIP) in which 30 students have taken part.

Early Identification Program in Medicine. The EIP was developed in 1981 by the Brown Medical School administration and the director of Tougaloo's Pre-Health Careers Program. Brown hoped the program would increase minority, especially African-American, representation in the Medical School student body. Tougaloo hoped the program would attract more students to careers in medicine, improve their preparation, increase the numbers of medical school options for their graduates, and guarantee placement in medical school.

On the recommendation of the Tougaloo faculty, in consultation with their Brown counterparts, two to three Tougaloo pre-med students are identified at the end of their sophomore year and guaranteed admission to Brown upon the successful completion of their Tougaloo education. They are formally notified of their acceptance and urged to participate in research and educational programs at Brown during the next two summers.

Two types of summer programs exist: research and didactic. The first summer usually is spent in one of the teaching hospitals under the tutelage of a Brown-affiliated faculty member in a research project. During the second summer the student takes courses based on needs identified by the Tougaloo faculty in relation to the Brown curriculum and the special needs of the student. Upon the completion of their Touglaoo degree and the summer programs, the students matriculate at Brown.

Funding for the summer programs comes from such federal and private sources as MARC, Health Careers Access, Southern Education Foundation, and the Howard Hughes Medical Research Institute. Travel, room and board, a stipend for the students and, at times, research support have been provided. Upon admission to the Medical School, the university's regular financial aid system takes over.

The EIP has had far more successes than failures—only five in ten years and of those only one was an academic failure, the others largely matters of social adjustment. Brown is now trying to emulate the EIP in other disciplines, especially biology, education, and history, to see if the model can be adapted as a way to entice more young people into teaching and research careers. The key problem is money: how to finance this kind of program in non-science fields where faculty members do not have the same kinds of research support as their colleagues in medicine. It is easy to identify the students, relatively easy to develop relationships between administrators and faculty, but difficult to finance.

After many years, Brown and Tougaloo recently have developed some structures to guard against a paternalistic relationship. Essential to a strong interinstitutional relationship is the endorsement of trustees and presidents. A written memorandum of understanding outlining the key ingredients in the relationship and the principles that inform it should be adopted by the boards of trustees at both institutions. The Tougaloo-Brown relationship thus has been restructured in the following ways:

(1) At both institutions there is now a Tougaloo-Brown Relations Committee that is approved by both Boards of Trust. It is important to have the relationship firmly based in the Boards of Trust.

(2) The presidents of both institutions meet regularly, and they, board members, and faculty participate in each other's commencement exercises.

(3) Brown and Tougaloo share to some degree in joint fund-raising efforts.

(4) Both institutions have begun to share equally in the cost of the exchange. In the past Brown paid for the coordinator of the project. Now each campus has designated a coordinator, and the funding for the effort is borne by both institutions.

(5) The faculty exchange component is being enhanced through the sharing of faculty and research resources.

Lessons Learned. (1) Minority students may need special support systems. (2) Appreciate the diversity of educational experiences and avoid superior-inferior approaches to anything that is done. (3) Brown, a highly secular, urban, "posh" university is not the best place for everyone. (4) Build and nurture strong, trusting relationships between key faculty and administrators. (5) Establish guidelines and rules that protect each institution with regard to the recruiting of students and faculty. (6) Leave the student identification largely in the hands of Tougaloo faculty who know better than the Brown deans who is likely to succeed at Brown. A proper "fit" between the student and the environment is important. (7) Determine from the beginning when students may travel from one institution to another. Students must be sophomores or older to participate in the Brown-Tougaloo exchange. (8) Have

good pre- and post-advising of exchange students who go to both institutions. (9) Coordinators at both institutions should advise students regarding details of the application process: financial aid forms, housing and travel arrangements, and the selection of courses. (10) Money must be available to maintain these candidates. (11) Set up clear rules and regulations regarding transfer of credits and the cost factors involved in the exchange program. (12) Establish at the outset the boundaries of the relationship in a written document agreeable to both parties. (13) Have the president or another university official host a reception for the exchange students on each campus.

Advantages. The Brown-Tougaloo relationship provides graduate and professional school opportunities for many African-American students at Tougaloo who might not have pursued these opportunities otherwise. It enables faculty and students to experience cultural diversity; some Tougaloo faculty members now have been to Brown to teach and conduct research. Faculty and students who participate in the exchange establish beneficial lifelong relationships with each other.

Advice. Brown and Tougaloo commend the interinstitutional relationship as a possible model, but it entails hard work, requires commitments at the highest level, and is expensive. Institutions that wish to engage in these programs have to commit themselves to providing a large portion of the funding out of their own operating and financial aid budgets. External funding is difficult to find.

Consortium for Graduate Opportunities for American Indians

Consortium members[10] are sixteen colleges and universities that have an institutional support infrastructure for Native American students. They cooperate in the recruitment of American Indian students to academic graduate programs in social sciences, humanities, sciences, and mathematics. The objectives of the Consortium are to identify a specific pool of undergraduate students at participating institutions and to provide systematic ways in which they may be encouraged to pursue graduate study.

Among the sixteen institutions are community colleges, four-year institutions, and research or aspiring research universities with graduate programs. Clara Sue Kidwell at the University of California at Berkeley was instrumental in founding the Consortium. Based on an informal network of people she had met over the years in working with Native American Studies programs, she sought to create an old boy/old girl network that would identify talented undergraduates, encourage them to attend graduate school, and assist them in getting into graduate school The Consortium was founded in 1985. For the first three years it had funding from The

[10]Haskell Indian Junior College, Lawrence, Kansas; Navajo Community College, Tsaile, Arizona and Shiprock, New Mexico; Fort Lewis College, Durango, Colorado; Montana State University, Bozeman; Northern Arizona University, Flagstaff; Northeastern State University, Tahlequah, Oklahoma; Southeastern State University, Durant, Oklahoma; University of Alaska, Fairbanks and Anchorage; Universityof Arizona, Tucson; University of California at Berkeley, Los Angeles and Santa Cruz; University of New Mexico, Albuquerque; University of Utah, Salt Lake City.

Ford Foundation. Thereafter Northern Arizona University became the headquarters for the Consortium, but there has been a struggle to get the financial support necessary to run this kind of coordination effort.

In its first three years the Consortium held 36 workshops, attended by some 500 students, to discuss reasons for attending graduate school and ways to finance it. A great deal of effort is spent on assisting students with applications to graduate schools and helping them identify sources of support.

At two faculty-student conferences scheduled in the early years of the Consortium, students talked about the research they were doing, and the faculty, some of whom were Native Americans, talked about why they went on to graduate school and their experiences there. One of the strengths of the Consortium is that it is able to organize a network of a limited number of Native American faculty members scattered across the 16 member institutions. Students therefore may have an opportunity to meet a Native American faculty member in their discipline even though there is not one at their home institution.

Now the Consortium is essentially an information-sharing network. For example, a student interested in forestry can send his or her name to the Consortium. Using a computer database, the Consortium sends the student's name to the schools that have a forestry graduate program. They also share information about financial sources and deadlines.

Lessons Learned. To make the Consortium truly effective, someone on each campus (a dean or someone in student affairs) needs to be committed to keeping the network alive and getting the faculty on campus to cooperate with those on other campuses. The Consortium needs a central office to share the information coming in and out. Member institutions need to develop and sign a formal agreement, contribute a small amount of money to a fund to help with such communications as a newsletter, and seek other support to cover the administrative overhead of the Consortium. In addition to coordinating the information exchange, the money could be used to send faculty members from one institution to conduct workshops at several others.

Ft. Lewis College in Durango, Colorado, is one of the Consortium's member institutions. It waives tuition for Native American students and has continued the tradition begun by the Consortium of having on-campus workshops to inform students about graduate opportunities. The college also encourages its Native American students to consider getting their Ph.D.s and returning to Ft. Lewis College to teach; the new president there is very supportive of a "grow your own" philosophy.

Encouraging Minority Participation in Graduate Education

Helping Minority Students Who "Stop Out"

Seeds of the graduate school idea planted in a minority student's mind may take a period of time to germinate. Many minority students are so financially burdened after four years of college that they need to earn some money before they go on to graduate school. Many of them do take time off but decide several years later to

return to graduate school. Consortia and university representatives can provide useful services for those students by giving them the information and assistance they need when they make a decision to attend graduate school.

They can keep in touch with those students; continue to encourage the students' aspirations for graduate education; provide information about graduate programs and funding; and assist them in preparing for GRE tests, completing the application, and getting their recommendations up to date. Consortium offices, minority student offices, or other identifiable places where the students know they can go for information and assistance may be especially effective in that regard.

Many minority students also tend to set educational goals in achievable increments. As they consider graduate school, a doctoral degree may seem overwhelming but a master's degree attainable. University representatives who work with minorities may be wise to encourage this incremental thinking, urging students who are undecided about their goals in graduate school to work first toward a master's degree and then persuading them to continue for the doctorate. The process requires staying in touch with those students, continuing to encourage and help them.

Recruiting through Student Organizations

The GEM Program (National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc.) has found student organizations to be an important component of successful recruiting into graduate programs. In engineering, GEM relies heavily on student organizations, e.g., American Science and Engineering Society, Society of Hispanic Professional Engineers, Mexican American Engineering Society, Society of Black Engineers, to let undergraduate students know about GEM fellowships. These student organizations have national constituencies and chapters all over the country. Consortia seeking to encourage minority students to pursue graduate degrees need to involve these organizations in their planning and recruiting efforts.

Faculty Members as Effective Graduate Recruiters

Undergraduates often perceive life as a faculty member to be dull and uninteresting. Professors need to tell undergraduate students about the exciting aspects of being a faculty member: that it is one of the few professions where a person can spend a lifetime doing what interests him or her most; that they are able to teach others about the field they love; that they have the flexibility to teach or do research at other institutions or abroad.

Graduate deans, administrators of consortia, and minority student offices need to schedule workshops, conferences, or meetings where faculty members and graduate students tell undergraduates why they decided to go to graduate school and become professors and what they like about the profession. Departments, as well as graduate schools, can conduct workshops on applying to graduate school. The CGS publication, *Graduate School and You*, can be distributed widely among faculty members and undergraduates.

Faculty members need to be made aware that they can encourage their best students to consider a professorial career through interactions in the classroom and outside. At

one university a graduate dean visited departments and talked to the department heads about encouraging their own students to go on to graduate school. A university president at a large midwestern university invited all the top minority students and all the minority faculty members to his house for dinner, and he asked the faculty members to talk about why they went into academics. A Mexican American student in agricultural economics who attended that dinner now is planning to go on for the doctorate. Faculty members who are enthusiastic about their careers can be the most effective missionaries of graduate education on campus.

Providing Money/Taking Calculated Risks

To expand the pool of minority students in graduate education will require additional money from a variety of sources for research fellowships or research assistantships. It also will require some flexibility in assessing a student's potential for graduate school when the GPA and GRE scores are not outstanding. Flexibility in applying standards must not, however, be done in such a way that minority students are identified as second-class citizens and ghettoized.

Mechanisms for addressing this issue already are used in some of the institutional arrangements described in this document. In the Brown-Tougaloo Early Identification Program in Medicine, Tougaloo faculty members identify and recommend students who they believe will succeed in medical school at Brown, and Brown University has learned over the years to trust their judgment. A similar relationship pertains in the CIC Alliance for Success. The six member HBCUs recommend their most able students for the Summer Research Opportunities Program, and students who have successful experiences in the SROP may be admitted, with financial support, to graduate school at a CIC institution even though their GPAs and GRE scores are less than optimal. The critical variables are relationships of trust among faculty members at the sending and receiving institutions, and the opportunity for minority students to have summer research experiences at a major university.

A third mechanism is the Undergraduate to Graduate School Bridge Program in the LBL/JSU/AGMEF Science Consortium. This bridge program offers students who have received their B.S. degrees from JSU and AGMEF an interim year of research at LBL so that they can gain additional experience before entering graduate school.

Universities that do target some graduate assistantships for minority students can insist that departments use them for that purpose or lose them. This requirement gives departments an incentive to look harder to find qualified minority students, not to admit those who are unqualified.

Financial assistance to minority graduate students is most effective when it is given as a research assistantship or research fellowship. The award should be prestigious but also should involve the student in the research and, in some cases, the teaching activities of the department from the very beginning. The retention rate of women and minority students with research assistantships and teaching assistantships tends to be higher than for those with straight fellowships.

Principles of Effective Institutional Cooperation

A Range of Options

The consortial arrangements described herein vary greatly, from two-member partnerships between universities or a university and a corporation to such multi-member consortia as the CIC Alliance for Success. The consortia may be comprehensive or non-comprehensive, and the numbers involved may vary accordingly. If a consortium deals with a particular issue, it may be easy to have a number of organizations involved; if it is comprehensive, however, it may be more effective to limit the numbers of institutions participating.

Comprehensive consortia seek to touch all bases, beginning with pre-college programs that can extend to grade school and progressing through summer and academic year research experiences to a transitional year of research between college and graduate school. In addition, comprehensive consortia may deal with all academic disciplines. Thus, comprehensive refers to breadth, either in parts of the pipeline or academic interest. Noncomprehensive consortia are more focused, and, as in the example above, can focus on a particular transition, such as undergraduate to graduate, or on a particular discipline or set of disciplines, such as science and/or engineering. Assessing the success of those programs in channelling more minority students into graduate education will provide valuable insights into the relative effectiveness of these approaches.

Promoting a Triangular Relationship Through Institutional Partnership Programs

Partnerships among institutions—research universities, national laboratories, or corporations paired with smaller institutions that have large minority populations—should enhance the work of all the participating faculty members and students. A priority should be to promote the triangular relationship among students, faculty members at the undergraduate institution, and faculty members or research scientists at a research university, national laboratory, or corporation.

At a minimum, faculty members at the research university and undergraduate institution should talk with each other and develop an ongoing relationship based on trust. They share a mutual interest in the students who participate in the summer programs and who may go on to graduate school. They should be able to discuss the student's progress and problems, understand the research in which he or she is engaged, and encourage the student's work and progress toward graduate school during the summer and the academic year. Through a stable, long-term relationship, the faculty member at the research university becomes able to trust the undergraduate faculty member's recommendations of students who can succeed in summer research programs and in graduate school. Consortia among institutions, such as the CIC Alliance for Success, can foster these ties by bringing together faculty members in a particular discipline, e.g. mathematics, from the participating institutions to discuss curriculum development and institutional changes that would be beneficial to all students.

In some institutional partnerships faculty and students alike derive benefits from the arrangement. The Lawrence Berkeley Laboratory/Jackson State University/Ana G.

Méndez Educational Foundation Science Consortium gives everyone involved an opportunity to participate. Students and faculty members at JSU and AGMEF are involved in collaborative research projects at LBL as well as at their home institutions. Research scientists at LBL and faculty members at JSU and AGMEF get to know one another through their shared research, and both are in a position to encourage and guide participating students throughout the year. Professors at JSU and AGMEF are enthusiastic about gaining access to major research projects without having to give up their primary role as faculty members. LBL in turn gains access to minority students and faculty members. The triangular relationship is mutually satisfying and reinforcing.

Foundations of Institutional Partnerships

1. Begin with a written memorandum of understanding stating the terms of the relationship and the principles that inform it. Careful planning should clarify what each participant hopes and needs to gain from the relationship.

2. Top administrators and the governing boards of the institutions involved should give the agreement their official approval.

3. A lead institution or organizational body should be in charge of the consortium or partnership.

4. Adequate, stable funding must be secured.

5. All members should provide administrative support.

6. Regular meetings should take place among coordinators from all of the participating institutions. Communication among the participants should be full and timely.

7. Inter- and intrainstitutional planning should be ongoing.

8. In cooperative projects among or between universities, the process of finding summer research placements for students should be decentralized so that an institution's undergraduate colleges and departments claim ownership of the program and remain committed to it.

9. Benefits should accrue to all the members.

10. Whenever possible, institutional partnerships should help strengthen science, engineering, and technology programs at the colleges or universities with a large minority student population. Institutional and faculty development benefits a much wider number of students than do summer research programs for a limited number of students.

11. Involvement with students should begin at the pre-college level.

12. Consortia and partnerships should consider the utility of providing minority students with a bridge year after their baccalaureate degrees, which would give them additional research experience before they enter graduate school.

13. Institutional patience should be present, permitting a long-term commitment to the partnership.

14. Evaluation of what the program has accomplished is essential. Tracking the post-baccalaureate careers of the minority student participants is especially important. Because the objective of these institutional partnership programs is to increase the numbers of minority students in graduate education, an accurate tally of the numbers must be kept. The success of any cooperative arrangement ultimately will be judged by the numbers of students it puts into the graduate school pipeline.

CGS Idea Exchange Summer Meeting 1991 Participants

Institutions and Consortia

CIC Alliance for Success
- Dr. Jean Girves, Committee on Institutional Cooperation
- Dr. Elaine Copeland, University of Illinois
- Dr. T. J. Bryan, Coppin State College

The Consortium for Minorities in Teaching Careers
- Mr. José F. Méndez, Ana G. Méndez Educational Foundation
- Dr. Max Weiner, Fordham University

Institutions and Corporations

The Science and Technology Alliance
- Mr. Richard Stephens, Department of Energy

Tuskegee University-Hughes Aircraft Company
- Dr. Vascar Harris, Tuskegee University

Institutions and National Laboratories

Lawrence Berkeley Laboratory/Jackson State University/Ana G. Méndez Educational Foundation Science Consortium
- Dr. Bettye Fletcher, Jackson State University
- Dr. Rollie Otto, Lawrence Berkeley Laboratory

NASA Programs
- Ms. Nancy Knott, NASA
- Ms. Elaine Schwartz, NASA
- Dr. Samuel Massenberg, Langley Research Center
- Mr. Robert Yang, Langley Research Center
- Dr. Ron Simmons, University of Virginia

Institution-Institution

Tougaloo College-Brown University
- Dr. Bettye Parker-Smith, Tougaloo College
- Dr. Charles Baldwin, Brown University

Consortium for Graduate Opportunities for American Indians
- Dr. Henry Hooper, Northern Arizona University
- Dr. Clara Sue Kidwell, University of California, Berkeley
- Dr. Mary Jean Mosely, Ft. Lewis College

Workshop Chair

Dr. Leslie McLemore, CGS Minority Committee/Jackson State University

Other Attendees

Dr. Mark Clark, CGS/University of Northern Colorado

Mr. Hector Garza, CGS Minority Committee/Eastern Michigan University

Dr. Ted Habarth, The GEM Program/Johns Hopkins University

Dr. Russell Hamilton, CGS Minority Committee/Vanderbilt University

Ms. Kay Hancock, Vanderbilt University

Dr. Mack Johnson, CGS Minority Committee/California State University, Northridge

Dr. Jules LaPidus, CGS

Dr. Thomas Linney, CGS

Dr. Jacqueline Looney, CGS Minority Committee/Duke University

Dr. William McHenry, CGS Minority Committee/National Science Foundation

Dr. Frank Morris, CGS Minority Committee/Morgan State University

Dr. Russ Snyder, Asst. to the Director, Committee on Institutional Cooperation

Dr. Mike Sullivan, Project 1000

Mr. Peter Syverson, CGS

Dr. Deborah Thomas, CGS Minority Committee/Yale University

Dr. Judith Toyama, CGS Minority Committee/University of Massachusetts, Amherst

Dr. Reginald Wilson, American Council on Education